

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

What is claimed is:

- Sub C1
1. A semiconductor package for a micro-machined semiconductor device, comprising:
- a) a substrate having a first surface and a second surface, the micro-machined semiconductor device located adjacent the first surface;
 - b) a plurality of vias, extending through the substrate between the first and second surfaces;
 - c) an electrical connection located between the vias and the micro-machined semiconductor device for electrically connecting the vias to the semiconductor device;
 - d) a seal, located between the micro-machined semiconductor device and the first surface for hermetically sealing the micro-machined semiconductor device;
 - e) a rigid support located between the micro-machined semiconductor device and the first surface for supporting the micro-machined semiconductor device during assembly; and
 - f) a plurality of solder spheres mounted to the second surface and electrically connected to the vias.

2. The semiconductor package according to claim 1, wherein the electrical connection includes:

- a) a first pad located on the micro-machined semiconductor device; and
- b) a second pad located on the first surface; and
- c) a solder joint connected between the first and second pad.

3. The semiconductor package according to claim 1, wherein the substrate is a low temperature co-fired ceramic.

4. The semiconductor package according to claim 1, wherein the seal is a ring of solder located adjacent an outer perimeter of the substrate.

5. The semiconductor package according to claim 1, wherein the rigid support is attached to the first surface.

6. The semiconductor package according to claim 5, wherein the rigid support is gold.

7. The semiconductor package according to claim 5, wherein the rigid support is an alloy of gold and palladium.

8. The semiconductor package according to claim 5, wherein the rigid support is ultrasonically deposited.

9. The semiconductor package according to claim 3, wherein the substrate has a plurality of layers.

10. The semiconductor package according to claim 10, wherein a plurality of circuit lines are located on the layers, the circuit lines connected between the vias.

11. The semiconductor package according to claim 1, wherein a ball pad is attached to the second surface, the solder sphere attached to the ball pad.

12. The semiconductor package according to claim 11, wherein the solder sphere is attached to the ball pad by a reflowed solder paste.

13. A semiconductor package for a micro-machined semiconductor device comprising:

- a) a low temperature co-fired ceramic substrate having a plurality of layers, the substrate having a top and a bottom surface;
- b) a plurality of vias, extending between the layers;
- c) a plurality of solder spheres, located on the bottom surface and electrically connected to the vias;
- d) a plurality of rigid supports, attached to the top surface;
- e) a seal located between the micro-machined semiconductor device and the top surface, the seal hermetically sealing the micro-machined semiconductor device;
- f) the micro-machined semiconductor device spaced from the top surface by the rigid supports such that a movable portion of the micro-machined semiconductor device is unconstrained for movement; and
- g) an electrical connection located between the vias and the micro-machined semiconductor device for electrically connecting the vias to the semiconductor device.

14. The semiconductor package according to claim 13, wherein the electrical connection includes:

- a) a first pad located on the micro-machined semiconductor device; and
- b) a second pad located on the top surface; and
- c) a solder joint connected between the first and second pad.

15. The semiconductor package according to claim 13, wherein the seal is a ring of solder located adjacent an outer perimeter of the substrate.

16. The semiconductor package according to claim 13, wherein the rigid support is gold.

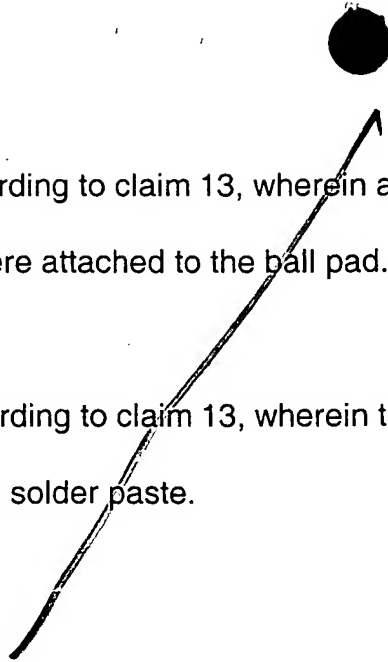
17. The semiconductor package according to claim 13, wherein the rigid support is an alloy of gold and palladium.

18. The semiconductor package according to claim 13, wherein the rigid support is ultrasonically deposited.

19. The semiconductor package according to claim 13, wherein a plurality of circuit lines are located on the layers, the circuit lines connected between the vias.

20. The semiconductor package according to claim 13, wherein a ball pad is attached to the bottom surface, the solder sphere attached to the ball pad.

21. The semiconductor package according to claim 13, wherein the solder sphere is attached to the ball pad by a reflowed solder paste.



11/11/2019 10:11:11 AM

22. A method of making a semiconductor package comprising the steps of:

- a) punching vias in at least two low temperature co-fired ceramic layers;
- b) filling the vias with a conductor;
- c) screen printing conductor lines on the layers;
- d) screen printing a seal ring and a plurality of pads on one of the layers;
- e) screen printing a plurality of ball pads on one of the layers;
- f) stacking the layers;
- g) laminating under pressure the layers into a substrate;
- h) firing the substrate in an oven;
- i) depositing a rigid support on the substrate;
- j) screening a first solder paste onto the seal ring and the pads;
- k) placing a micro-machined semiconductor device onto the substrate;
- l) reflowing the first solder paste in an oven such that the micro-machined semiconductor device is attached to the substrate;
- m) screening a second solder paste onto the ball pads;
- n) placing a plurality of solder spheres onto the ball pads; and
- o) reflowing the second solder paste in an oven such that the solder spheres are attached to the ball pads.

23. The method according to claim 22, wherein the rigid support is an ultrasonically deposited metal.

24. The method according to claim 22, wherein the metal is chosen from the group

consisting of:

- a) gold; and
- b) an alloy of gold and palladium.

11/11/2019 10:11:11 AM